

CLAIMS

1. A vinyl-cis-polybutadiene rubber containing 1,2-polybutadiene and a polymer substance of a melting point lower than that of the 1,2-polybutadiene and with at least one unsaturated double bond per repeating unit, where the 1,2-polybutadiene and the polymer substance are dispersed at physically and/or chemically adsorbed states in the cis-polybutadiene rubber as the matrix component of the vinyl-cis-polybutadiene rubber.
2. The vinyl-cis-polybutadiene rubber according to claim 1, where the 1,2-polybutadiene and the polymer substance are dispersed in short crystal fiber and/or particle in the cis-polybutadiene rubber as the matrix component of the vinyl-cis-polybutadiene rubber.
3. The vinyl-cis-polybutadiene rubber according to claim 1 or 2, where the 1,2-polybutadiene is 1,2-polybutadiene of a melting point of 170°C or more and the polymer substance is at least one selected from polyisoprene, crystallizable polybutadiene of a melting point of 150°C or less, liquid polybutadiene and derivatives thereof.
4. The vinyl-cis-polybutadiene rubber according to any

of claims 1 through 3, where the unsaturated polymer substance is contained within a range of 0.01 to 50 % by mass to the total of the crystal fiber of the 1,2-polybutadiene and cis-polybutadiene rubber.

5. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 4, where the viscosity of the cis-polybutadiene rubber as the matrix component in toluene solution at 25°C is within a range of 10 to 150.

6. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 5, where  $[\eta]$  of the cis-polybutadiene rubber as the matrix component is within a range of 1.0 to 5.0.

7. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 6, where the content of the 1,4-cis structure of the cis-polybutadiene rubber as the matrix component is within a range of 80 % by mass or more.

8. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 7, where the Mooney viscosity of the cis-polybutadiene rubber as the matrix component of the vinyl-cis-polybutadiene rubber is within a range of 10 to 50.

9. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 8, where the polymer substance is a matter insoluble in boiling n-hexane.

10. The vinyl-cis-polybutadiene rubber according to any of claims 1 through 9, where the 1,2-polybutadiene is dispersed in short crystal fiber in the cis-polybutadiene rubber as the matrix component of the vinyl-cis-polybutadiene rubber and the polymer substance is dispersed in particle therein, and where the short crystal fiber of the 1,2-polybutadiene is dispersed in the particle of the polymer substance.

11. The vinyl-cis-polybutadiene rubber according to claim 11, where the short crystal fiber of the 1,2-polybutadiene is never contained in the particle of the polymer substance but is also dispersed in the cis-polybutadiene rubber as the matrix component, and where the length of the short crystal fiber dispersed in the matrix along major axis is within a range of 0.2 to 1,000  $\mu\text{m}$  and the length of the short crystal fiber of the 1,2-polybutadiene dispersed in the particle of the polymer substance along major axis is within a range of 0.01 to 0.5  $\mu\text{m}$ .

12. A butadiene rubber composition prepared by

compounding a vinyl-cis-polybutadiene rubber according to claim 1 or 2 at 10 to 300 parts by weight per 100 parts by weight of a rubber selected from natural rubber, polyisoprene rubber, styrene-butadiene copolymer rubber, or a blend rubber of at least two types thereof.

13. A butadiene rubber composition for tire, where a vinyl-cis-polybutadiene rubber according to claims 1 through 11, and/or a butadiene rubber composition according to claim 12 is used.

14. A method for producing vinyl-cis-polybutadiene rubber by a step of the cis-1,4 polymerization of 1,3-butadiene using a cis-1,4 polymerization catalyst in a hydrocarbon-series solvent, a step of the 1,2 polymerization of 1,3-butadiene in the concurrent presence of a 1,2 polymerization catalyst in the resulting polymerization mixture to generate 1,2-polybutadiene of a melting point of 170°C or more, and a step of the separation and recovery of vinyl-cis-polybutadiene rubber generated from the resulting polymerization mixture, the method including a step of adding a polymer substance with at least one unsaturated double bond per repeating unit to the production system of vinyl-cis-polybutadiene rubber.

15. The method for producing vinyl-cis-polybutadiene

rubber according to claim 14, where the polymer substance is at least one selected from polyisoprene, crystallizable polybutadiene of a melting point of 0°C to 150°C, liquid polybutadiene, and derivatives thereof.

16. The method for producing vinyl-cis-polybutadiene rubber according to claim 14 or 15, where the amount of the polymer substance to be added to the production system is within a range of 0.01 to 50 % by mass to the vinyl-cis-polybutadiene rubber to be obtained.

17. The method for producing vinyl-cis-polybutadiene rubber according to any of claims 14 through 16, where the step of adding the polymer substance to the production system is carried out in the polymerization mixture at an appropriate time point from the step of the cis-1,4 polymerization step to the step of the separation and recovery of the vinyl-cis-polybutadiene rubber generated from the polymerization mixture obtained after the completion of the 1,2 polymerization.

18. The method for producing vinyl-cis-polybutadiene rubber according to any of claims 14 through 17, where the hydrocarbon-series solvent is a hydrocarbon-series solvent with a solubility parameter of 9.0 or less.

19. A butadiene rubber composition prepared by compounding the vinyl-cis-polybutadiene rubber obtained by a production method according to any of claims 14 through 18 at 10 to 300 parts by mass per 100 parts by mass of a rubber selected from natural rubber, polyisoprene rubber, styrene-butadiene copolymer rubber or a blend rubber of at least two types thereof.

20. A butadiene rubber composition for tire, where the vinyl-cis-polybutadiene rubber obtained by a production method according to any of claims 14 through 18 and/or a butadiene rubber composition according to claim 12, 13 or 19 is used.